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Case report

"Add-on pacing lead": An effective and safe alternative to lead replacement in ICD pacing failure

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ABSTRACT

Despite recent advances in implantable cardioverter defibrillator (ICD) technology, the long-term reliability of ICD leads remains a significant problem. Lead failures constitute a major risk for patients with an implantable cardioverter defibrillator. There is no clear consensus on treatment strategy of ICD lead failure and decision should be individualized. We report a pacing-dependent elderly male with ICD lead pacing failure secondary to insulation break resulting in recurrent syncope. We emphasize the technique of "Add-on pacing lead implantation" could be an effective and alternative to ICD lead replacement.

1. Introduction

The implantable cardioverter defibrillator (ICD) has become the standard of care for treatment of patients with potentially life-threatening ventricular tachyarrhythmia. The number of patients who have ICDs has dramatically increased over the last several years. Concomitantly, the number of patients having a device that is recalled or that malfunctions has increased. ICD generators and leads are more prone to failures than are pacing systems alone and management of these patients potentially dependent on "recalled" devices to deliver life-saving therapy. Despite recent advances in ICD technology recognition and appropriate management of ICD malfunction have become the "Achilles heel" of defibrillator therapy.

2. Case report

An 80-year-old gentleman presented with history of recurrent syncope of 1 day duration. He gave past history of chronic stable angina for which he underwent coronary artery bypass graft (CABG) surgery 25 years back with three saphenous venous grafts to left anterior descending (LAD), major oblique marginal (OM) and posterior descending arteries (PDA). Twelve years later he underwent re-do CABG for progressive dyspnea and angina secondary to occlusion of all three grafts. In view of severe left ventricular dysfunction and documented one episode of ventricular tachycardia (VT) he also underwent automated implantable cardioverter defibrillator (AICD) (Guidant-Vitality 2EL VR, Belgium, with EndoTAK DSP-dual coil lead [manufactured by Guidant; Model No: 0125])

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implantation. For next 13 years he was symptomatically better and required only one hospitalization for AICD battery replacement. Elective AICD interrogation at regular intervals did not reveal any episodes of VT or VF. The previous interrogation and records showed intermittent AV block for which he required intermittent pacing (~40%).

His ECG showed sinus rhythm with complete heart block. There were intermittent pacing spikes without ventricular capture. On ICD interrogation both sensing and pacing malfunction was detected. The pacing impedance was too low (210 Ohm) and threshold was very high (>10 V). AICD interrogation showed adequate life of battery status. However shock impedance was found normal. The ICD interrogation data was suggestive of insulation break.

On fluoroscopy and chest radiograph there was no obvious evidence of lead fracture. In view of symptomatic complete heart block immediately temporary pacemaker implantation was done through right femoral approach. He was posted for ICD lead replacement. Despite obtaining left subclavian venous access, we encountered resistance in passage of the 6F venous sheath. Subclavian venogram revealed a very thin caliber vein, prompting us to change our strategy. In view of the normal battery status of the device, impaired pacing parameters and normal defibrillation shock impedance, we decided that an add-on RV pacing lead would suffice. The new 5F RV pacing lead (Guidant File line bipolar passive fixation tined lead-4457; Belgium) was introduced and after confirming the lead parameters it was connected to the same ICD generator through pacing lead port (Fig. 1A and B). The proximal end of old pacing port was capped. The threshold was 0.6 V, impedance was 746 Ohm and R wave was >10 mV. The shock impedance was rechecked and confirmed to be normal. However defibrillator threshold was not checked in view of severe LV dysfunction (LVEF: 15%) and recent history of TIA. There was no procedure-related complications.

At 3 months follow-up the AICD interrogation revealed one episode ventricular tachycardia which was successfully terminated by anti-tachycardia pacing (ATP) and normal pacing function (~92%). At 6 months follow-up there were no episodes of VT or VF of inappropriate shock.

3. Discussion

With the increased implantation of ICDs, concern about the long-term reliability of ICD leads has become an increasing concern.[1,2] Implantable cardioverter defibrillator leads are significantly more complex than pacemaker leads and, as a result, may be inherently more susceptible to failure. One recent meta-analysis of device registries demonstrated a 20-fold higher incidence of ICD failure compared with pacemakers.[3] This is mainly because of the complexity in the engineering aspects of ICDs when compared to pacemakers.

ICD lead dysfunction may result in failure of the device to deliver therapy for ventricular tachycardia or from loss of pacing in pacemaker-dependent patients and, thus, result in syncope or sudden death. Lead dysfunction may also result in inappropriate shocks and subsequent psychological distress, need for operative revision or removal resulting in additional morbidity and mortality.

Our patient underwent ICD implantation 12 years back and he also underwent pulse-generator replacement once 6 years later. His ICD lead malfunction was discovered during presentation as recurrent syncope. These episodes were secondary to intermittent complete heart block (CHB) as revealed by ICD interrogation. ICD lead malfunction secondary to insulation break was responsible for failure to detect and pace during CHB.

Most device malfunctions are not due to recall related failures. Most malfunctions are due to random component failures. Currently, there is no ICD ever marketed that has a malfunction rate lower than 0.1%. Recent data suggest that 2% of all implanted defibrillators are removed due to malfunction,[4] ICD leads have an even more striking failure rate. A long-term study of ICD leads showed a 20% failure rate at 10 years of follow-up.[5] This observation should be particularly

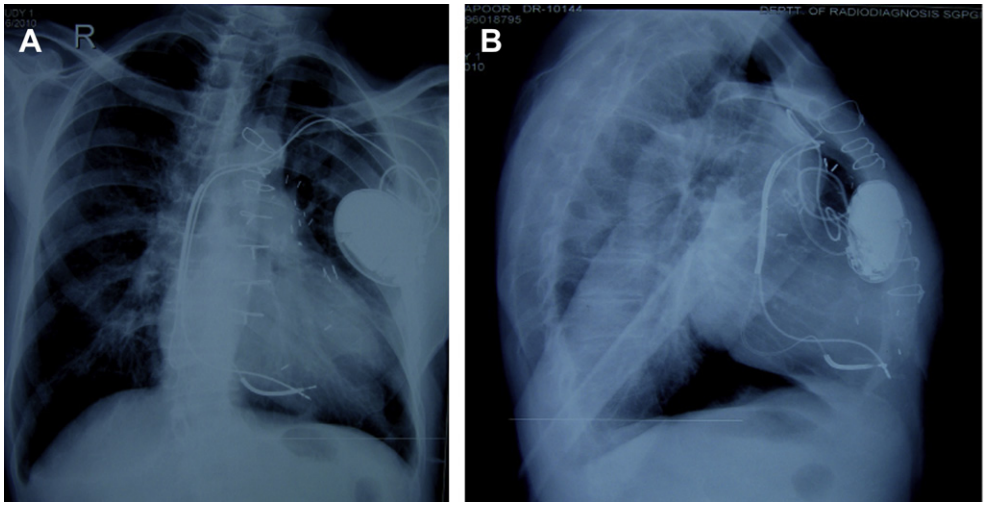

Fig. 1 – Chest radiograph in PA (Panel A) and lateral (Panel B) showing ICD implanted in left prepectoral area through left subclavian vein approach. Also seen is the "Add-on pacing lead" placed in RV and connected to same generator.

concerning for younger patients who might have the potential for multiple lead failures during their lifetime.

ICD leads have always been the "weakest link" in the ICD system, with failure rates far exceeding those of ICD generators. The failure rate for ICD leads may be up to 15% at 5 years and 40% at 8 years.[5] ICD lead failures are often clinically silent as seen in our patient, and early detection before clinical presentation with inappropriate shocks or sudden death is important. ICD generators and leads may fail due to design flaws, manufacturing problems, implant techniques, mechanical stress, the high voltage stresses (up to 800 V) imposed on the leads, chemical reactions between insulation materials and metallic components, and attempts to downsize the lead diameters or aging and fatigue of materials.[4–6] In our patient the pacing failure may be due to aging of the lead resulting in insulation break.

There is no consensus on the optimal management strategy of ICD generator or lead failure/malfunction. In a study conducted by Ellenbogen et al[7] fifteen patients who underwent laser lead extraction and replacement with a new ICD lead, 2 patients had their ICD leads capped and a new ICD lead implanted. One patient had a new sensing lead implanted, and one patient had a new ICD system implanted in the right pectoral region.

Management of a known ICD lead failure is theoretically simple (i.e., provide a new lead) but often difficult in practice. Difficulties lies in the decision to extract the failed lead or, more simply, to add a new lead. Thrombosis of the venous system may complicate lead replacement by requiring lead extraction to restore vascular access or by requiring movement of the ICD system to the contralateral side. Extraction of ICD leads carries a major complication rate (including death) of 1%–3%.[8] There are no randomized studies for these treatment strategies, and the decisions must be individualized for each patient.

As our patient had tined ICD lead during initial implantation we did not attempt extraction of the old lead considering the risk involved with it. Moreover the laser extraction technology was not available at our hospital. But we could not introduce a new ICD lead through the same venous access because of thin caliber of the vein. Hence we opted for an alternative technique to avoid lead replacement i.e., the introduction of "Add-on pacing lead" since our patient had normally functioning defibrillator component of ICD. However defibrillation threshold testing assumes greater importance when one is leaving the old lead in-situ and adding a new defibrillation lead, due to the potential of lead to lead interaction. However we did not check defibrillation threshold in view of poor left ventricular function. The success of the treatment option was further supported by appropriate pacing for intermittent CHB and one incidence of successful ATP for VT.

4. Conclusion

Although improvements in technology have solved many problems associated with ICD therapy, the detection and optimal management of issues related to ICD generator and lead failure/malfunction still remain. ICD lead failure may occur late during the follow-up after lead implantation and may pose problem in elderly pacemaker-dependent individuals. "Add-on pacing lead" may be an effective, safe and alternative to lead replacement in isolated pacing malfunction. However these patients need continued careful clinical follow-up of ICD leads to determine long-term reliability.

Conflicts of interest

All authors have none to declare.

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